determining an on-off state of a dot and which of the N different dots is to be created in each pixel based on density data obtained by error diffusion distribution of an error, said error representing a difference between a density to be expressed in a processed pixel and a density expressed by a dot actually created in the pixel.

15. (Amended) A recording medium in which a program for driving a printer is recorded in a computer readable manner, said printer creating a plurality of dots and thereby printing an image on a priming medium, said program causing a computer to attain the functions of:

determining an on-off state of a dot and which dot is to be created in each pixel based on density data obtained by error diffusion distribution of an error, said error representing a difference between a density to be expressed in a processed pixel and a density expressed by a dot actually created in the pixel; and

adding preset noise data to either one of input tone data and at least a part of a plurality of threshold values for tone values of said input tone data, prior to the determination.

REMARKS

Favorable reconsideration of this application as presently amended and in light of the following discussion is respectfully requested.

Claims 1-15 are presently active, Claims 1, 5, 9, and 12-15 having been amended by way of the present amendment.

In the outstanding Office Action, the drawings were objected to for not including reference numerals mentioned in the description. Claims 5, 9, 13, and 15 were rejected under 35 U.S.C. §112, second paragraph, as being indefinite. Claims 1-8, 12, and 14 were rejected

under 35 U.S.C. §102(b) as being unpatentable by Toshiaki et al (EP 0820187 A2). Claims 9-11, 13, and 15 were rejected under 35 U.S.C. §103(a) as being unpatentable over Toshiaki et al in view of Shiau et al (U.S. Pat. No. 5,880,857) and further in view of well-known prior-art.

Firstly, Applicants acknowledge with appreciation the courtesy of Examiner Vida and Supervisory Examiner Williams to conduct an interview on March 20, 2003, in which the issues identified in the outstanding Official Action were discussed. As noted on the Interview Summary Sheet, almost all the issues regarding the objection to the drawings were resolved. However, further clarification of Figures 10 and 11 was requested. During the interview, the 35 U.S.C. §112, second paragraph, rejection to Claims 5, 9, 13, and 15 were discussed with suitable changes to Claims 9, 13, and 15 agreed to and a tentative change to Claim 5 suggested.

Applicant's representative discussed during the interview differences between the claimed inventions and Toshiaki et al. It was pointed out, in the claimed invention and as illustrated by way of example in Applicant's Figure 20, that the determination an on/off state of a dot and which of the different dots to be created is based on density data obtained by error diffusion distribution. The density data obtained by error diffusion distribution, shown illustratively as step S205 of Applicant's Figure 20, is made prior to a selection of a large dot in step S240 or prior to a selection of a small dot in S235. In Toshiaki et al, as shown in Figure 11 therein, a determination is made at step S120 of on/off state of a "deep" dot (i.e. a selection of a dot having a dark color hue), and then error diffusion analysis is applied at step S130. Likewise, a determination is made at step S140 of on/off state of a "light" dot (i.e. a selection of a dot having a light color hue), and then error diffusion analysis is applied at step S160. Hence, in Toshiaki et al, a determination of a type of dot to be created is made without

regard to error diffusion distribution. Thus, the claimed invention having a determination of an on-off state of a dot and which of N different dots is to be created in each pixel determination made based on an error diffusion distribution precalculates the error distribution before a type of dot (e.g. a size of the dot) is selected, as noted on the Interview Summary Sheet. Whereas, Toshiaki et al determines the on/off state of the dot before an error diffusion analysis. No agreement on patentability was reached pending further consideration.

As noted, the claimed inventions utilize an error diffusion method (e.g. the error diffusion distribution recited in Claim 1) in which as defined the error represents a difference between a density to be expressed in a processed pixel and a density expressed by a dot actually created in the pixel. As such, the error diffusion distribution can smoothly change a dot recording ratio (e.g., a dot recording ratio with regard to large dots) in multi-valuing, in accordance with a tone value.[2] As shown in Applicant's Figures 16-19, threshold values used in error diffusion characteristically change over an entire range of tone values. The claims define a multi-valuing unit configured to determine an on-off state of a dot and which of the N different dots is to be created in each pixel based on density data obtained by an error diffusion distribution of an error. Thus, the multi-valuing unit is affected by the error diffusion distribution.

Toshiaki et al disclose a multi-valuing technique which uses a "dither" matrix method.[3] As pointed out in the Office Action, Toshiaki et al perform an error diffusion step; however, the disclosed error diffusion is performed after the on/off state of the dots is

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[2]Specification, page 23, lines 4-13.

[3]Toshiaki et al, page 1, see Abstract, and page 11, lines 26-32.

determined by the dither matrix method. Accordingly, it is respectfully submitted that Toshiaki et al do not at all consider the density data obtained by reflecting the difference when creating different dots.

Moreover, dependent Claims 2, 5, and 6 define features exemplifying how threshold values are to be used in error diffusion. The dither matrix taught by Toshiaki et al does not correspond to the threshold value features defined in dependent Claims 2, 5, and 6.

Given the understanding of the differences between that of the claimed inventions and that of Toshiaki et al reached during the interview and given the furthered explanation expounded above, it is respectfully submitted that Claims 1, 9, and 12-15 patentably define over the applied prior art.[4]

Secondly, regarding the drawing objection, a Letter Requesting Approval of Drawing Changes is submitted herewith showing marked in red on Figure 10 a denotation of the dotted box as control circuit 40 and showing marked in red on Figure 11 a distributor 55.[5] With these changes to Figures 10 and 11 and with support in Figure 3 for control circuit 40, support in Figure 1 for the computer 90, support in Figure 10 for distributor 55, and disclosure in the specification on page 3 for the position sensor 39 shown in Figures 3 and 10, it is respectfully submitted that the objection to the drawings has been overcome.

Thirdly, regarding the 35 U.S.C. §112, second paragraph, rejection, Claims 9, 13, and 15 have been amended as discussed during the interview, and Claim 5 has been amended to recite that the threshold value storage unit is configured to determine a difference between

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[4]The amendments being made to Claims 1, 9, and 12-15 were made solely for the purpose of clarification and were not made to further distinguish the claim language from the applied prior art.

[5]Support for the dotted box in Figure 10 being a control circuit 40 is found in the specification, page 15, lines 4-5.

corresponding threshold values according to the input tone value. The difference having a plurality of points where a linear differential coefficient of the difference changes from minus to plus or plus to minus. By the difference changing from plus to minus or minus to plus, as defined in Claim 5, the difference changes sharply with respect to the tone value. Indeed, the setting of a threshold value and the depiction a linear differential coefficient of the difference changing from minus to plus or plus to minus are exemplified in Applicant's Figure 15. Thus, it is respectfully submitted that Claim 5 particularly points out the claimed invention, and that the 35 U.S.C. §112, second paragraph, rejection has been overcome.

Hence, with no remaining objections or rejections, it is respectfully submitted that the application, as amended herewith, is believed to be in a condition for allowance. An early and favorable action to that effect is respectfully requested.

Respectfully submitted,

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IN THE CLAIMS

Please amend the claims as shown below:

1. (Amended) A printer-system that creates a plurality of dots and thereby prints an image on a printing medium, said printer-system comprising:

a head configured to produce N different [types of] dots having different densities per unit area, where N is an integer of not less than 2;

an input unit configured to input tone data with respect to each of the pixels included in an original image;

a threshold value storage unit configured to store a plurality of threshold values according to possible tone values that the input tone data may take, the threshold values including respective threshold values that correspond to P different [types of] dots, where P is an integer satisfying $2 \leq P < N$;

a multi-valuing unit configured to determine an on-off state of a dot and [a type of the] which of the N different dots is to be created in each pixel[,] based on density data obtained by an error diffusion distribution of an error, said error representing a difference between a density to be expressed in a processed pixel and a density expressed by a dot actually created in the pixel[, into unprocessed pixels]; and

a dot creation unit configured to drive said head and create the N different [types of] dots having different densities per unit area[,] based on results of the determination.

5. (Amended) A printer-system in accordance with claim 1, wherein the threshold value storage unit is configured to determine a difference between [the] corresponding threshold values [has a plurality of turning values] according to the input tone value, said difference having a plurality of points where a linear differential coefficient of the difference changes from minus to plus or plus to minus.

9. (Amended) A printer-system that creates a plurality of dots and thereby prints an image on a printing medium, said printer-system comprising:

a head configured to produce N different [types of] dots having different densities per unit area, where N is an integer of not less than 2;

an input unit configured to input tone data with respect to each of the pixels included in an original image;

a multi-valuing unit configured to determine an on-off state of a dot and [a type of the] which of the N different dots is [dot] to be created in each pixel[,] based on density data obtained by an error diffusion distribution of an error, said error representing a difference between a density to be expressed in a processed pixel and a density expressed by a dot actually created in the pixel [into unprocessed pixels];

a dot creation unit configured to drive said head and create the N different [types of] dots having different densities per unit area[,] based on results of the determination; and

a noise addition unit that adds preset noise data to either one of the input tone data and at least a part of [the] a plurality of threshold values for tone values of said input tone data, prior to the determination by said multi-valuing unit.

12. (Amended) A method of creating a plurality of dots and printing an image on a printing medium with a head that enables creation of N different [types of] dots having different densities per unit area, where N is an integer of not less than 2, said method comprising steps of:

(a) inputting tone data with respect to each of pixels included in an original image;

(b) referring to data that stores a plurality of threshold values according to possible tone values that the input tone data may take and determining the plurality of threshold values corresponding to the input tone data, the plurality of threshold values including corresponding threshold values that correspond to P different [types of] dots, where P is an integer satisfying $2 \leq P < N$;

(c) determining an on-off state of a dot and [a type of the dot] which of the N different dots is to be created in each pixel based on density data obtained by error diffusion distribution of an error, said error representing a difference between a density to be expressed in a processed pixel and a density expressed by a dot actually created in the pixel[, into unprocessed pixels];

(d) driving said head and creating the N different [types of] dots having different densities per unit area[,] based on results of the determination carried out in said step (b); and

(e) driving said head and creating the N different [types of] dots having different densities per unit area, based on results of the determination carried out in said step (c).

13. (Amended) A method of creating a plurality of dots and printing an image on a printing medium with a head that enables creation of N different [types of] dots having different densities per unit area, where N is an integer of not less than 2, said method comprising the steps of:

(a) inputting tone data with respect to each of pixels included in an original image;

(b) determining an on-off state of a dot and [a type of the dot] which of the N different dots is to be created in each pixel based on density data obtained by error diffusion distribution of an error, said error representing a difference between a density to be expressed in a processed pixel and a density expressed by a dot actually created in the pixel[, into unprocessed pixels];

(c) driving said head and creating the N different [types of] dots having different densities per unit area[,] based on results of the determination carried out in said step (b); and

(d) adding preset noise data to either one of the input tone data and at least a part of [the] a plurality of threshold values for tone values of said input tone data, prior to the determination carried out in said step (b).

14. (Amended) A recording medium in which a program for driving a primer is recorded in a computer readable manner, said printer creating a plurality of dots and thereby printing an image on a printing medium, said program causing a computer to attain the functions of:

referring to data, which stores a plurality of threshold values according to possible tone values that input tone data may take, and determining the plurality of threshold values corresponding to the input tone data, the plurality of threshold values including corresponding threshold values that correspond to at least two different [types of] dots having different densities per unit area; and

determining an on-off state of a dot and [a type of the dot] which of the N different dots is to be created in each pixel based on density data obtained by error diffusion distribution of an error, said error representing a difference between a density to be expressed in a processed pixel and a density expressed by a dot actually created in the pixel[, into unprocessed pixels].

15. (Amended) A recording medium in which a program for driving a printer is recorded in a computer readable manner, said printer creating a plurality of dots and thereby [priming en] printing an image on a priming medium, said program causing a computer to attain the functions of:

determining an on-off state of a dot and [a type of the] which dot is to be created in each pixel[,] based on density data obtained by error diffusion distribution of an error, said error representing a difference between a density to be expressed in a processed pixel and a density expressed by a dot actually created in the pixel[, into unprocessed pixels]; and

adding preset noise data to either one of [the] input tone data and at least a part of [the] a plurality of threshold values for tone values of said input tone data, prior to the determination.